LOAN DOCUMENT

AD-A227 827

DTIC ACCESSION NUMBER

PHOTOGRAPH THIS SHEET

DTIC COPY

LEVEL

INVENTORY 1

WRDC-TR-90-8025

DOCUMENT IDENTIFICATION

DEC 1990

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

DISTRIBUTION STATEMENT

HANDLE WITH CARE

ACCESSION FOR
NTIS GRA&I
DTIC TRAC
UNANNOUNCED
JUSTIFICATION

BY
DISTRIBUTION/
AVAILABILITY CODES

DISTRIBUTION	AVAILABILITY AND/OR SPECIAL
A-1	

DISTRIBUTION STAMP

DTIC
ELECTE
OCT 25 1990
D
E

DATE ACCESSIONED

DATE RETURNED

90 [illegible] 27

DATE RECEIVED IN DTIC

REGISTERED OR CERTIFIED NUMBER

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-FDAC

DTIC FORM 70A JUN 90

DOCUMENT PROCESSING SHEET

PREVIOUS EDITIONS MAY BE USED UNTIL STOCK IS EXHAUSTED

LOAN DOCUMENT

WRDC-TR-90-8025

GEOMETRIC MODELING APPLICATIONS INTERFACE PROGRAM

SYSTEM COMPONENTS OPERATOR'S MANUAL

United Technologies Corporation
Pratt and Whitney
Government Products Division
P.O. Box 9600
West Palm Beach, Florida 33410-9600

DECEMBER 1990

Final Report For Period August 1985 - March 1989

Approved for public release; distribution unlimited

MANUFACTURING TECHNOLOGY DIRECTORATE
WRIGHT RESEARCH AND DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-6533

NOTICE

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This report is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

Charles R. Gilman

Charles Gilman
Project Manager

Walter H. Reimann, Chief
Computer-Integrated Mfg. Branch

FOR THE COMMANDER

Bruce Rasmussen

BRUCE A. RASMUSSEN
Chief, Integration Technology Division
Manufacturing Technology Directorate

If your address has changed, if you wish to be removed from our mailing list, or if the addressee is no longer employed by your organization please notify WRDC/MTI, WPAFB, OH 45433-6533 to help us maintain a current mailing list.

Copies of this report should not be returned unless return is required by security considerations, contractual obligations, or notice on a specific document.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) FR 20435	5. MONITORING ORGANIZATION REPORT NUMBER(S) WRDC-TR-90-8025
6a. NAME OF PERFORMING ORGANIZATION United Technologies Corporation Pratt & Whitney Government Products Division 6b. OFFICE SYMBOL (If applicable) (P&W)	7a. NAME OF MONITORING ORGANIZATION Wright Research and Development Center Manufacturing Technology Directorate (WRDC/MTI)
6c. ADDRESS (City, State and ZIP Code) P.O. Box 9600 West Palm Beach, Florida 33410-9600	7b. ADDRESS (City, State and ZIP Code) Wright-Patterson AFB OH 45433-6533
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F33615-85-C-5122
8c. ADDRESS (City, State and ZIP Code)	10. SOURCE OF FUNDING NOS.

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT NO.
78011F	MTPI	06	74

11. TITLE (Include Security Classification)
GEOMETRIC MODELING APPLICATIONS INTERFACE PROGRAM

12. PERSONAL AUTHOR(S)
C. Magnuson, C. Van Wie, D. Emmerson

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Yr., Mo., Day)	15. PAGE COUNT
Final	FROM 1 Aug 85 TO 31 Mar 89	November 1990	55

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR.	Geometric Modeling Applications Interface Program Product Definition Data Interface Turbine Blades and Disks

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This Operator's Manual describes the system operating commands and software installation procedures for the 3 major system components of the Computer Integrated Manufacturing program known as GMAP (Geometric Modeling Applications Interface Program), U.S. Air Force Contract F33615-85-C-5122. These components are the System Translator, Schema Manager, and Model Access Software with Name Value Interface

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
UNCLASSIFIED/UNLIMITED X SAME AS RPT. ___ DTIC USERS ___	UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE NUMBER (Include Area Code)	22c. OFFICE SYMBOL
David Judson	(513) 255-7371	WRDC/MTI

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

18. Subject Terms (Continued)

Product Life Cycle
Engineering
Manufacturing
Interface
Exchange Format
CAD
CAM
CIM
IBIS
RFC
System Translator
Schema Manager
Model Access Software
Name/Value Interface

FOREWORD

This Operator's Manual (OM) describes work performed under Air Force Contract F33615-85-C-5122, Geometric Modeling Applications Interface Program (GMAP), covering the period 1 August 1985 to 31 March 1989. This OM describes the system operating commands and software installation procedures for the contract which is sponsored by the Computer Integrated Manufacturing Branch, Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio 45433-6533. The GMAP Project Manager for the Air Force is Mr. Charles Gilman.

The primary contractor is Pratt & Whitney, an operating unit of United Technologies Corporation. Pratt & Whitney engaged several additional firms as subcontractors including the United Technologies Research Center (UTRC), McDonnell Aircraft Company (MCAIR), and International TechneGroup Incorporated (ITI) to assist in various tasks of the program. At Pratt & Whitney, the program is managed by Mr. Richard Lopatka. Ms. Linda Phillips is the Program Integrator, and Mr. John Hamill is the Deputy Program Manager.

Note: The number and date in the upper right corner of each page in this document indicate that it has been prepared in accordance to the ICAM CM Life Cycle Documentation requirements for a Configuration Item (CI).

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

SECTION 1

SCOPE

1.1 IDENTIFICATION

This Operator's Manual describes the system operating commands and software installation procedures for the System Components of the Geometric Modeling Applications Interface Program (GMAP). There are 3 major System Components, the System Translator, Schema Manager, and the Model Access Software with the Name/Value Interface. This project was developed under Air Force Contract F33516-85-C-5122.

1.2 INTRODUCTION

This manual is intended for use by computer operators and programming personnel. It is assumed that personnel installing this software are familiar with the "native" system installation requirements and procedures.

The associated GMAP User's Manuals provide individual guides for use of the GMAP System Translator, Schema Manager Software, Model Access Software and the Name Value Interface Software.

Capabilities documented in the System Translator User's Manual (CI UM560240021U) include "PUT" a GMAP model into the Working Form and "GET" a GMAP model from the Working Form via the Model Access Software using the GMAP System Translator.

The Model Access Software User's Manual (CI UM560240031U) provides a guide for application programmers to use the Model Access Software. Capabilities described in that document are Model Access Software Initialization, Entity Creation, Deletion and Manipulation, and List Operations.

The Schema Manager User's Manual (CI UM560240021U) describes how to define CAD/CAM entities suitable for the Working Form of the Model Access Software.

The GMAP system component software was designed to be transportable and has been operated on IBM 43xx, 308x or DEC VAX 11/780 computers. These environmental requirements are described in Section 3 of this document. This document does not address local (native) system or computing environment documentation.

1.3 DOCUMENT APPROACH

This Operator's Manual is divided into four main sections: Scope, References, System Operations, and System Installation. Appendices provide supplemental information.

Section 1 — Scope of this document.

Section 2 — Reference documentation applicable to GMAP and this document.

Section 3 — The GMAP architecture at a high level, system environmental needs, and system interfaces.

Section 4 — System installation procedures to install GMAP on IBM 43xx computers and the running of the Time Sharing Option/MVS operating system.

Appendix A — Listing of VAX and IBM files used for system installation.

Appendix B — VAX and IBM PASCAL implementation differences.

Appendix C — Datasets used and a description of each.

SECTION 2

REFERENCES

2.1 REFERENCE DOCUMENTS

The following technical reports, specifications, standards, and other documents have been referred to or are relevant to this System Components Operator's Manual.

2.1.1 Military

Integrated Computer Aided Manufacturing (ICAM) Architecture, Vol. 4, Function Modeling Manual (IDEF0), USAF Report No. AFWAL-TR-81-4023, June 1981.

Integrated Computer Aided Manufacturing (ICAM) Architecture, Vol. 5, Information Modeling Manual (IDEF1), USAF Report No. AFWAL-TR-81-4023, June 1981.

Integrated Computer Aided Manufacturing (ICAM) Documentation Standards, IDS 150120000C, September 1983.

PDDI System Specification, Product Definition Data Interface (PDDI) Project 5601, Contract F33516-82-5036, July 1984.

PDDI System Specification-Draft Standard, Product Definition Data Interface (PDDI), Project 5601, Contract F33516-82-5036, July 1984.

Information Modeling Manual IDEF-Extended (IDEF1X) Integrated Information Support System (IISS), ICAM Project 6201, Contract F33615-80-C-5155, December 1985.

Interim Technical Report No. 1 (ITR560240001U)
"Geometric Modeling Applications Interface Program" February 1986
(Period 1 August 1985 — 31 October 1985).

Interim Technical Report No. 2 (ITR560240002U)
"Geometric Modeling Applications Interface Program" May 1986
(Period 1 November 1985 — 31 January 1986).

Geometric Modeling Applications Interface Program (GMAP) Scoping Document, CI SD560240001U, May 1986.

Interim Technical Report No. 3 (ITR560240003U)
"Geometric Modeling Applications Interface Program" August 1986
(Period 1 February 1986 — 30 April 1986).

Interim Technical Report No. 4 (ITR560240004U)
"Geometric Modeling Applications Interface Program" November 1986
(Period 1 May 1986 - 31 July 1986).

Geometric Modeling Applications Interface Program (GMAP) Needs Analysis Document, CI NAD560240001U, November 1986.

Interim Technical Report No. 5 (ITR560240005U)
"Geometric Modeling Applications Interface Program" January 1987
(Period 1 August 1986 — 31 October 1986).

Geometric Modeling Applications Interface Program (GMAP) System Requirements Document, CI SRD560240001U, February 1987.

Geometric Modeling Applications Interface Program (GMAP) State of the Art Document, CI SAD560240001U, March 1987.

Interim Technical Report No. 6 (ITR560240006U)
"Geometric Modeling Applications Interface Program" May 1987
(Period 1 November 1986 — 31 January 1987).

Geometric Modeling Applications Interface Program (GMAP) System Specification (Volumes I-IV), CI SS560240001U, July 1987

Interim Technical Report No. 7 (ITR560240007U)
"Geometric Modeling Applications Interface Program," August 1987
(Period 1 February 1987 — 30 April 1987).

Geometric Modeling Applications Interface Program (GMAP) System Design Specification, CI SDS560240001U, November 1987.

Geometric Modeling Applications Interface Program (GMAP) to Retirement for Cause Interface Development Specification, CI DS560240011U, November 1987.

Geometric Modeling Applications Interface Program (GMAP) to Integrated Blade Inspection System Interface Development Specification, CI DS560240021U, November 1987.

Geometric Modeling Applications Interface Program (GMAP) to Retirement for Cause Interface As-designed Product Specification, CI PS560240011U, December 1987.

Geometric Modeling Applications Interface Program (GMAP) to Retirement for Cause Interface Unit Test Plan, CI UTP560240011U, December 1987.

Interim Technical Report No. 8 (ITR560240008U)
"Geometric Modeling Applications Interface Program," December 1987
(Period 1 May 1987 — 31 July 1987).

Interim Technical Report No. 9 (ITR560240009U)
"Geometric Modeling Applications Interface Program," March 1988
(Period 1 August 1987 — 31 October 1987).

Geometric Modeling Applications Interface Program (GMAP) System Test Plan, CI STP560240001U, March 1988.

Product Definition Data Interface (PDDI)/Geometric Modeling Applications Interface Program (GMAP) Deliverables Roadmap Document, March 1988.

Geometric Modeling Applications Interface Program (GMAP) to Integrated Blade Inspection System Interface Unit Test Plan, CI UTP560240021U, March 1988.

Geometric Modeling Applications Interface Program (GMAP) to Integrated Blade Inspection System Interface As-designed Product Specification, CI PS560240021U, March 1988.

Geometric Modeling Applications Interface Program (GMAP) System Component As-designed Product Specification, CI PS560240031U, March 1988.

Interim Technical Report No. 10 (ITR560240010U)
"Geometric Modeling Applications Interface Program," August 1988
(Period 1 November 1987 — 31 January 1988).

Interim Technical Report No. 11 (ITR560240010U)
"Geometric Modeling Applications Interface Program," August 1988
(Period 1 February 1988 — 30 April 1988).

Geometric Modeling Applications Interface Program (GMAP) to Retirement for Cause Interface User Operator Manual, CI U/OM560240011U, August 1988.

Interim Technical Report No. 12 (ITR560240012U)
"Geometric Modeling Applications Interface Program" October 1988
(Period 1 May 1988 — 31 July 1988).

Geometric Modeling Applications Interface Program (GMAP) to Retirement for Cause Interface Unit Test Report, CI UTR560240011U, November 1988.

Geometric Modeling Applications Interface Program (GMAP) to Integrated Blade Inspection System Interface Unit Test Report, CI UTR5602421U, November 1988.

Geometric Modeling Applications Interface Program (GMAP) System Translator User Manual, CI UM560240021U, November 1988.

Geometric Modeling Applications Interface Program (GMAP) to Retirement for Cause Interface As-built Product Specification, CI PS560240012U, February 1989.

Geometric Modeling Applications Interface Program (GMAP) to Integrated Blade Inspection System Interface As-built Product Specification, CI PS560240022U, February 1989.

Geometric Modeling Applications Interface Program (GMAP) System Components Operator's Manual, CI OM560240001U, February 1989.

Geometric Modeling Applications Interface Program (GMAP) to Integrated Blade Inspection System Interface User/Operator Manual, CI U/OM560240021U, February 1989.

Geometric Modeling Applications Interface Program (GMAP) Schema Manager User's Manual, CI UM560240011U, February 1989.

Interim Technical Report No. 13 (ITR560240013U)
"Geometric Modeling Applications Interface Program" February 1989
(Period 1 May 1988 — 31 July 1988).

2.1.2 Commercial

A Practical Guide to Splines, C. de Boor, Applied Mathematical Sciences, Vol. 27, Springer-Verlag.

Design of Database Structures, T. J. Teorey and J. P. Fry, Prentice-Hall, Inc., Englewood Cliffs, N.J.

Differential Geometry of Curves & Surfaces, M. P. de Carmo, Prentice-Hall, Inc., 1976.

IDEF1X Readers Reference, D. Appleton Company, December 1985.

Identification of Product Definition Data in a Manufacturing Enterprise — A Case Study. R. Lessard, United Technologies Research Center and R. Disa, Pratt & Whitney, March 1986.

Use of Product Models in a CIM Environment, D. Koziol Emmerson and K. Perlotto, Pratt & Whitney, March 1987.

Technical Issues in Product Data Transfer, Richard Lopatka, Pratt & Whitney, September 1987.

Implementation of GMAP Technologies for Logistic Support Applications, Donald L. Deptowicz, Pratt & Whitney, January 1988.

Barriers to PDES Approval, Anthony Day, Sikorsky, and Richard Lopatka, Pratt & Whitney, April 1988.

PDD: Implementation Issues, Diane Emmerson and Priscilla Blasko, United Technologies Corporation, Proceedings of AUTOFACT '88, October 1988.

2.1.3 Standards Organizations

ANSI Y14.5M, Dimensioning and Tolerancing.

"The ANSI/X3/SPARC DBMS Framework Report of the Study Group on Database Management Systems," **Information Systems**, Vol. 3, pp. 173-191, 1978.

The Second Draft Report of the Ad Hoc Committee on the Content and Methodology of the IGES Version 3 (The Second PDES Report), K. Brauner and D. Briggs, November 1984.

EXPRESS — A Language for Information Modeling, ISO, TC184/SC4/WG1, January 1986.

The STEP File Structure, ISO, TC184/SC4/WG1, January 1987.

Mapping from EXPRESS to Physical File Structure, ISO, TC184/SC4/WG1, January 1987.

2.2 TERMS AND ACRONYMS

A glossary of terms frequently used in GMAP which may be included in this System Components Operator's Manual is provided below. A list of acronyms and abbreviations used in GMAP is also included in this section.

2.2.1 Terms Used in GMAP

Accept/Reject/Incomplete Notice — A display on the cell computer that indicates the final status of the engine disk.

Accept	= Acceptable within tolerance specified by engine manufacturer
Reject	= Rejected because of flaw(s) outside the range of acceptable tolerances
Incomplete	= Part cannot be inspected

Access Software — A set of routines for creating, managing, and querying an incore Working Form model.

Administrative Data — The set of data which define the part characteristics, materials, approvals, and other miscellaneous information necessary to the production environment.

Angular — An angular size tolerance is used to tolerance the size of an angular feature independent of its angular location along an arc.

Application — A method of producing a specific result.

Application Request — A request initiated by an application program, either through batch or interactive processing, which will interrogate the model through the PDDI Access Software to obtain or operate on specific information regarding the model and its components or elements.

Application Requested Data — The data which fulfill the application's original request and which is in the proper format and readable by the application.

Architecture — A design or orderly arrangement.

ASCII — American Standard Code for Information Interchange.

As-Is — The present condition.

Attribute — A quality of characteristics element of any entity having a name and a value.

B-Spline — A spline defined by a control polygon, B-spline basis functions, and an associated knot vector. A Bezier curve is a special case of a B-spline; a nurb is the most general case of a B-spline.

Bezier Curve — A type of curve defined by a set of vertices called a control polygon and a set of basis functions. The basis functions are known as Bernstein polynomials. K vertices define a curve of order K-1.

Binding — Establishing specific physical references to data structures for an application program; may be performed at compile time or at run time.

Blend — A smooth, continuous transition from one surface to another.

Body of Revolution (BOR) Representation — A topology in which an object is represented as the volume swept by a curve rotated about a line. This is a boundary representation in which the curve represents the surface area of the object.

Boundary Representation — A topology imposed on 3-D geometric entities to yield a general solid model. That model describes an object by describing its boundary area.

Bounded Geometry — Geometry that has limits defined by its mathematical domain or range.

Calibration Block Parameters (Scale Factors) — Nondestructive test parameters used to adjust a specific cell. These parameters are obtained from the calibration blocks located at each cell.

Circumferential — A circumferential tolerance specifies the tolerance zone within which the average diameter of a circular feature must lie. The average diameter is the actual circumference divided by pi (3.14159). A circumferential tolerance is a specific example of a peripheral or perimeter tolerance for a general curve.

Class — A collection of entities that are alike in some manner.

CLIST — IBM Command lists.

Composite Curve — A group of curve segments that are C^0 continuous.

Compound Feature Representation — An enumerative feature representation in which at least one component is itself a feature. For example, a bolt hole circle might be represented as a list of individual hole features.

Concentricity (Generic) — A concentricity tolerance specifies a cylindrical tolerance zone within which the axis of a feature must lie, where the axis of the zone coincides with the axis of the datum.

Conceptual Schema — Formally specified global view that is processing independent, covering information requirements and formulation of independent information structures. A neutral view of data, usually represented in terms of entities and relations.

Conic — A quadratic curve represented in the most general case by the equation:

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0.$$

A conic may be a circle, line, ellipse, parabola, or a hyperbola depending on the coefficients, A, B, C, D, E, and F.

Constraints (Generic) — An assertion to explicitly specify data meaning or semantics.[1]

Context-Free Grammar — The syntax of the language gives a precise specification of the data without interpretation of them.

Constituent — A specific instance of an entity that is used in the defination of some other entity.

Curve Segment — A subset of an underlying curve defined by a curve and bounded by two end points.

Data Dictionary — A catalog of all data elements in a design, giving their name, definition, format, source, and usage. May also include data types and value limits.

Defining Airfoil Sections — A planar or conical section that depicts an airfoil profile. Defining airfoil sections are those that meet aerodynamic requirements. Other intermediate sections are added for Manufacturing purposes.

Dimension — A part dimension is a quantifiable value expressing size, form, or location.

Domain — The set of values permissible in a given context.

Dynamic Allocation — The allocation (and deallocation) of memory resources as required by the application. The opposite is **static** allocation where a fixed size segment of memory is available to the application.

Eddy Current Cell — Hardware used to perform an Eddy current inspection operation (surface flaws).

Eddy Current Inspection — An inspection method used to detect internal potential flaws on a disk. It is based on the principle of sending electromagnetic signals to a target area on a part and detecting/interpreting reflection (Eddy current) from the target.

Eddy Current Scan Plan — An interpreter code program controlling the Eddy current inspection of a particular geometry.

[1] T.J. Teorey and J.P. Fry, Design of Database Structures, 1st edition, Prentice-Hall, Inc., Englewood Cliffs, N.J., p. 463.

Eddy Current/Ultrasonic Flaw Data Printout — A printout containing size and location information about specific flaw(s) (both critical and noncritical) associated with a particular part.

Entity — A description of a person, place, or thing, about which information is kept.

External Reference — A reference to some quantity of data that exists somewhere outside the scope of the immediate body of information.

Feature — A part feature in the dimensioning and tolerancing context is a feature in the sense of ANSI Y14.5M, that is, a physical component portion of a part, such as a surface, hole, slot, and so on, that is used in a tolerancing situation. In the dimensioning and tolerancing context, a feature consists of individual or groups of basic shape elements used to define the physical shape of an item. This general dimensioning and tolerancing use of features is to be distinguished from Features. The word "features" alone implies dimensioning and tolerancing features. The term "form feature" is described below.

Feature Pattern — A geometric pattern of occurrences of similar form features, for example, a circular pattern of scallops, a rectangular array of holes.

Feature Representation (Generic) — A description of a form feature within the context of a geometric model.

Feature Type — A name applied to a form feature that is suggestive of its shape and size, for example, hole, slot, web.

Feature of Size (Generic) — A feature of size provides a geometric location capable of being referenced for use with datums and tolerances. A feature of size can be a GMAP feature, or other referenceable shape elements of a part model that are symmetric about a point, line, plane, axis, curve, and so on. When a feature of size is used in a relationship with a tolerance or datum, its feature of symmetry is the implied reference.

Flat Pattern Representation (Extrusion Representation) — A topology in which an object is represented as the volume swept by a planar polygon moving in a direction normal to its plane. The polygon may have internal polygon represent the surface area of the object.

Flaw Characteristics — Location, length, width, depth, and nondestructive test parameters associated with a specific flaw.

Flaw Data Packet — Packet containing nonevaluated flaw data. Note that the packet can contain zero flaws.

Flaw Orientation — The direction of the major characteristic of the flaw with respect of the part coordinate system.

Flaw Suspect Location — The coordinate location of a possible flaw detected during a survey mode inspection (six-axis position of ultrasonic cell, seven-axis position of Eddy current cell).

Form Feature — A portion of a part's geometry that is useful to regard as an entity. In a boundary representation context, this is a subset of the part's surface area.

Form Tolerance — Form tolerances are used to control the form of model features. A form tolerance specifies the amount that an actual features form may vary from nominal. Form tolerance include straightness tolerance, flatness tolerance, roundness/circularity tolerance, cylindricity tolerance, perpendicularity tolerance, parallelism tolerance, angularity tolerance, profile-of-a-line tolerance, profile-of-a-surface tolerance, circular-runout tolerance, true-direction tolerance, and mismatch tolerance.

Functionality — (1) To show that the configuration item has fulfilled the specified requirements. (2) The receiving and sending systems can operate on the entity in the same manner with the same results within a pre-defined tolerance.

Function Modeling — A description of a system in terms of a hierarchy of functions or activities, each level decomposing higher ones into greater detail. Functions are named by verbs; nouns related are declared as inputs, controls, outputs, and mechanisms.

Geometric Element (Generic) — An instance of a geometric entity.

Geometric Group — A group of geometric entities with a name.

Geometric Model — A part description in terms of its underlying geometric elements. The model may be a wireframe, surface, or solid model.

Geometric Pattern — A circular or rectangular pattern of geometric entities.

GMAP Feature — A GMAP feature consists of a useful collection (for some application) of one or more part faces that, because of utility, are regarded as a single thing. The faces do not necessarily appear in the geometric model of the part; the feature may be described (represented) without being realized in the geometric model. GMAP features are analogous to form features. (Refer to **Features** data needs, above.)

Group Technology Code — An alphanumeric string identifying significant characteristics of a product, enabling group technology applications. Also known as Part Classification Code.

Include File — PASCAL source code from another file or library included on the compilation of a PASCAL source file.

Input Data — That information which the application needs to supply in order to interrogate or operate on the model. These data may assume only these forms prescribed by the PDDI Access Software specification.

Inspection Cycle — A period for which nondestructive testing inspection requirements are defined.

Inspection Cycle Zone — An entity that is composed of a unique combination of zone and inspection cycle.

Inspection Module Operator — Refers to personnel operating RFC cell(s).

Instrument Setting Adjustments — Nondestructive testing parameter adjustments automatically accomplished via pre- and post-calibration operations. These adjustments have to be accomplished within a predetermined tolerance.

Internal Flaw — A subsurface anomaly.

Internal Flaw Major Characteristic — A vector determined by an agreed upon method.

Example (1): The vector of greatest magnitude from the centroid to a boundary of the anomaly.

Example (2): A vector representing the major axis of the minimum ellipsoidal envelope encompassing the anomaly.

Internal Flaw Tolerance — A unique combination of:

(a) Internal flaw orientation range.
(b) Serviceable internal flaw tolerance limits.
(c) Repairable internal flaw tolerance limits.

Internal Flaw Tolerance Limit — A unique combination of:

(a) Maximum diameter.
(b) Maximum depth below surface.
(c) Maximum thickness.

Interpreted Request — Input data which have been appropriately modified to conform to the PDDI Access Software's internal data representation so that they may be further processed.

Job Control Language — IBM language used to identify a job and describe its requirements to an operating system.

Key Attribute — An attribute or combination of attributes having values that uniquely identify each entity instance.[2]

Laminates Representation (Generic) — A topology in which an object is represented as layers of flat material of known thickness.

Location Tolerance — Location tolerances specify the allowable variation in position of model features. Location tolerances include various forms of position tolerancing conventions. These are (true) position, concentricity, alignment, rectilinear location, and angular location.

Logistics Support — The function of procuring, distributing, maintaining, replacing, and repairing material in support of a delivered product.

Machine Coordinate Positions — The probe location with respect to machine coordinates.

Machine Preset Data — Machine coordinate adjustments automatically accomplished via pre- and post-calibration operations. These adjustments have to be accomplished within predetermined tolerance.

Metadata — Data about data. Defines the physical schema and record formats of the part data.

[2] Integrated Computer Aided Manufacturing (ICAM) Architecture, Vol. 5, Information Modeling Manual (IDEF1), USAF Report NO. AFWAL-TR-81-4023, June 1981, p. 212.

Metamodel — A body of data that defines the characteristics of a data model or structure.

Model — A collection of PDD that is transferable, displayable, accessible, and equivalent to a Part. The internal representation of the application data, as initiated and organized by the user. The model is also referred to as the Working Form.

Model Network Definition — The set of rules and definitions which outline in detail the data structure whereby higher order entities may be composed of lower order entities, or constituents, and the lower order entities may be constituents of one or more higher order entities.

Native System — The PDD and applications in a format that is unique to the database of a CAD system.

Nonconstructive Feature Representation (Explicit Feature Representation) — A feature representation that at least partially depends on a declaration that a face, or portion of a face, is "in" the feature.

Nondestructive Testing Parameters — Parameters used by the Eddy current and ultrasonic instruments (examples: amplitude, phase angle, gain, threshold, and so on).

Nondestructive Testing Personnel — Personnel responsible for the generation of scan plans and derivation of applicable nondestructive testing instrument settings used in the scan plans.

Nonshape Data — Produce definition data that cannot be represented by shape elements.

Normal Forms — Conditions reflecting the degree of refinement and control over the relationships and entities in an information model.

Numerical Control Program (Complete and Proposed) — Set of program instructions used to generate a probe path.

Orientation Range — An envelope in which the major flaw characteristic must lie.

Parse — The process of analyzing input strings (records) to identify fields and to verify that the data have a valid format.

Part Blueprint — A blueprint provided by the engine manufacturer of a particular F100 engine disk.

Physical Schema — Internal representation of data; the computer view that includes stored record format and physical ordering of stored records.

Polynomial Spline — A parametric spline of order 1, 2, or 3 defined by a set of N+1 points. The spline is CX, CY, or CZ continuous and defined by coefficients such that:

$$x(i) = AX_{(i)} + BX_{(i)} * S + CX_{(i)} * S**2 + DX_{(i)} * S**2$$

$$y(i) = AY_{(i)} + BY_{(i)} * S + CY_{(i)} * S**2 + DY_{(i)} * S**2$$

$$z(i) = AZ_{(i)} + BZ_{(i)} * S + CZ_{(i)} * S**2 + DZ_{(i)} * S**2$$

and a parameter space $(T_0, T_1, \ldots T_n)$

where

$$T_{(i)} <= u <= T_{(i+1)}$$

$$S = u - T_{(i)}$$

Position Tolerance — A position tolerance (true position) specifies a tolerance zone within which the feature may vary in any direction.

Post-processor — A phase of the translator where data are received from the Exchange Format and are converted to the Working Form.

Pre-processor — A phase of the translator where data are taken from the Working Form and are converted to the Exchange Format.

Primitive Constructive Feature Representation (Generic) — A constructive representation that is noncompound and that does not incorporate another feature. Such a representation must consist solely of overt construction information. Representation of a through hole by centerline and diameter is an example.

Probe Blueprint — Blueprint of Eddy current probe supplied by the probe manufacturer.

Product Definition Data — Those data "explicitly representing all required concepts, attributes, and relationships" normally communicated from Design throughout Manufacturing and Logistics Support. The data include both shape and nonshape information required to fully represent a component or assembly so that it can be analyzed, manufactured, inspected, and supported. They enable downstream applications, but do not include process instructions. These data are not always finalized at the design release; the manufacturing process can also add to the product model or generate derived manufacturing product models.

Product Life Cycle — Includes design, analysis, manufacturing, inspection, and product and logistics support of a product.

Product Model — A computer representation of a product.

Product Support — The function that interprets customer requests for information and can provide the technical responses to the customer in the form of technical orders and instructions.

Proprietary Part Flaw Data — Formatted dataset containing proprietary data defining size(s), maximums, and location(s) of critical flaw(s) (dimensional and locational tolerance).

RAW.0 File — A data file that uses a bi-cubic patch surface representation to define the surfaces of an airfoil.

Ready Status — Go/No-Go decision.

Relation — A logical association between entities.[3]

Remount Decision — Decision to remount an engine disk.

Replicate Feature Representation (Generic) — A description of a feature as being identical to another feature except for location. Mathematically, a replicate feature representation consists of the identification of another (necessarily constructive) feature plus a transformation.

Robot Initialization Parameters — A set of nondestructive testing parameters used to initialize the robot on an Eddy current or ultrasonic cell.

Rotational Sweep — A sweep in which the swept curve is rotated about a line (the "centerline" of the sweep).

Ruled Surface (Generic) — A surface defined by a linear blend of two curves.

Run System — The Translator subpackage which provides the communication interface between the user and the pre/post-processors.

Run-Time Subschema — A subset of the data dictionary information used at run-time by the access software to provide field data and check data.

Scan Plan — Instructions that drive an inspection; these include inspection area geometry, ordered inspection path points, inspection probe selection, inspection path for each probe, mechanical commands that allow mechanical manipulator positioning, instrument setting, and all the variables needed for signal processing and flaw data acquisition during inspection.

Scan Plan Specifications — Standards and procedures used in creating Eddy current and ultrasonic scan plans for the RFC system.

Schema — Formal definition of information structure. See Conceptual Schema, Physical Schema, Run-time Schema.

Shape — The physical geometry of a mechanical part, as distinguished from a computer description of that geometry. Where the difference is significant, the attitude is taken that shape is nominal or basic, with shape variations of tolerances grafted thereon.

Shape Data — Include the geometric, topological description of a product along with the associated dimensional tolerances and feature descriptions.

Shape Representation — A computer description of shape. The description may be partial in the sense that not all aspects of part shape are indicated. For example, a body of revolution representative of a turned part may not describe the nonaxisymmetric aspects of part geometry. A solid model must be complete and unambiguous in the sense that it describes a single volume in 3-D space.

[3] Ibid., p. 214.

Single Spatial Probe/Transducer Path — The starting and ending location of a single probe movement.

Size Tolerance — Size tolerances specify the allowable variation in size-of-model features, independent of location. Size tolerances include circumferential, rectilinear size, and angular size.

Solid Geometric Model (Shape Representation) — A computer description of shape. The description may be partial in the sense that not all aspects of part shape are indicated. For example, a body of revolution representation of a turned part may not describe the nonaxisymmetric[4] aspects of part geometry. A solid model must be complete and unambiguous in the sense that it describes a single volume in 3-D space.

Solid Modeling — The creation of an unambiguous and complete representation of the size and shape of an object.

Source Code — A computer program written in some language which is processed to produce machine code.

Spline — A piecewise polynomial of order K, having continuity up to order K-1 at the segment joints.

Squirter Blueprint — Blueprint of the squirter head that houses the ultrasonic transducer.

Subface — A subface is a bounded portion of a face. It is defined by an underlying face, exactly one periphery closed curve and zero, one, or more internal closed curves that represent cutouts or holes in the region. The internal closed curve must not touch or intersect each other or the periphery closed curve and must be entirely contained within the periphery closed curve.

Surface Flaw — A surface anomaly.

Surface Flaw Major Characteristic — A vector determined by an agreed upon method.

Example: A vector representing the major axis of the minimum elliptical envelope encompassing the anomaly in the plane of the surface.

Surface Flaw Tolerance — A unique combination of:

(a) Surface flaw orientation range.
(b) Serviceable surface flaw tolerance limits.
(c) Repairable surface flaw tolerance limits.

Surface Flaw Tolerance Limit — A unique combination of:

(a) Maximum length.
(b) Maximum width.
(c) Maximum depth.

[4] Ibid., p. 211.

Sweep Surface — Surfaces formed by extruding or revolving a planar profile in space.

Syntax — Grammar: A set of rules for forming meaningful phrases and sentences from words in a vocabulary.

System Computer — VAX 11/780 and supporting peripheral hardware.

System Constraints — Those hardware and software environmental constraints which will be imposed upon the PDDI Access Software that will limit its implementaiton and application. An example of such constraints might be the particular compiler used to compile the PDDI Access Software package.

To-Be — The future condition possible, given a proposed capability.

Tolerance (Generic) — The total amount by which something may vary. For mechanical product definition, tolerances can be shape tolerances, weight tolerances, finish tolerances and so on. In the context of GMAP, the term "tolerance" used alone implies shape tolerance. Other forms of tolerance (nonshape) are explicitly stated, for example, "finish tolerance." In a GMAP product model, tolerances occur without dimensions. As in the Product Definition Data Interface Program, model dimensions are implicit in the model geometry. Therefore, application of a tolerance implies a specific underlying dimension or geometric condition.

Topology — A data structure that assembles geometric entities (points, curves, surfaces) into a solid geometric model.

Transducer Blueprint — Blueprint of ultrasonic transducer supplied by the transducer manufacturer.

Transfer Data — The data required to make an exchange of data between systems (i.e., delimiters, record counts, record length, entity counts, numeric percision).

Translator — A software MECHANISM that is used for passing data between the Exchange Format and Working Form of the PDD.

Ultrasonic Cell — Hardware used to perform ultrasonic inspection operation (internal flaws).

Ultrasonic Inspection — An inspection method used to detect surface flaws on a disk. It uses ultrasonic waves through a stream of water to send and collect signals concerning an area targeted for inspection.

Ultrasonic Scan Plan — Interpreter code program controlling the ultrasonic inspection of a particular geometry.

Unbounded Geometry — Geometry represented parametrically, without limits, usually by coefficients to a defining equation.

Unigraphics (UG) — A computer graphics system.

User Function (UFUNC) — An interface to the UG database.

Working Form — Product definition data information in machine-dependent data formats; a memory resident network model.

Zone — A physical area of the disk composed of zone components.

Zone Component — A subface, face, or feature that constitutes a zone or element of a zone.

2.2.2 Acronyms Used In GMAP

ADB — Application Data Block (also referred to as Attribute Data Block).
AIMS — Automated IDEF Methodology System.
ANSI — American National Standards Institute.
ANT — Abstract of New Technology.
APT — Automatically Programmed Tools.
ATP — Automation Technology Products
BOM — Bill of Materials.
BOR — Body of Revolution.
BPI — Bits per Inch.
BREP — Boundary Representation.
CAD — Computer Aided Design.
CAE — Computer Aided Engineering.
CAEDS — Computer Aided Engineering Design System.
CALS — Computer-aided Acquisition and Logistics.
CAM — Computer Aided Manufacturing.
CAM-I — Computer Aided Manufacturing--International.
CAPP — Computer Aided Process Planning.
CAS — Cooled Airfoil System.
CDM — Common Data Model.
CDR — Critical Design Review.
CDT — Component Design Technology.
CFSR — Contract Fund Status Report.
CI — Configuration Item.
CIM — Computer Integrated Manufacturing.
CLIST — IBM Command List.
CM — Configuration Management.
CMM — Coordinate Measuring Machine.
C/SSR — Cost/Schedule Status Report.
CWBS — Contract Work Breakdown Structure.
DBMS — Data Base Management System.
DCL — DEC Command Language.
DDL — Data Definition Language.
DEA — Digital Equipment Automation.
DEC — Digital Equipment Corporation.
DES0 — (ICAM) Architecture of Design.
DJR — Design Job Request; Drafting Job Request.
DoD — Department of Defense.
DS — Design Specification.

DSM	— Design Substantiation Memo.
EBCDIC	— Extended Binary Coded Decimal Interchange Code (IBM Character Set).
EC	— Eddy Current.
ECO	— Engineering Change Order.
EDM	— Electrical Discharge Machining.
EF	— Exchange Format.
EII	— Engineering Information Index.
EMD	— Engineering Master Drawing.
EPCS	— Engine Product Configuration Support.
ESA	— Engineering Source Approval.
ESP	— Experimental Solids Proposal.
FEDD	— For Early Domestic Dissemination.
FEM	— Finite-Element Modeling.
FOF	— Factory of the Future.
FOS	— Feature of Size.
FPIM	— Fluorescent Penetrant Inspection Module.
FSCM	— Federal Supply Code for Manufacturers.
GE	— General Electric.
GMAP	— Geometric Modeling Applications Interface Program.
GSE	— Ground Support Equipment.
HCF	— High-Cycle Fatigue.
IBIS	— Integrated Blade Inspection System.
IBM	— International Business Machines.
ICAM	— Integrated Computer Aided Manufacturing.
ICOM	— Input/Control/Output/Mechanism.
ICS	— Information Computer System.
IDEF	— ICAM Definition.
IDEF0	— IDEF Function Modeling.
IDEF1	— IDEF Information Modeling.
IDEF1X	— IDEF Extended Information Modeling.
IDEF2	— IDEF Dynamics Modeling.
IDSS	— Integrated Decision Support System.
IEEE	— Institute of Electrical and Electronics Engineers.
IEN	— Internal Engineering Notice.
IFS	— Interface Specification.
IGES	— Initial Graphics Exchange Specification.
IISS	- Integrated Information Support System.
ILC	— Improved Life Core.
IMS	— Information Management System.
IPGS	— (IBIS) Inspection Plan Generation Subsystem.
IRB	— Industry Review Board.
IRIM	— Infrared Inspection Module.
ISO	— International Standards Organization.
ITA	— Intelligent Task Automation.
ITI	— International TechneGroup Incorporated.
ITR	— Interim Technical Report.
LCF	— Low-Cycle Fatigue.
MAS	— Model Access Software.

MCAIR	— McDonnell Douglas Corporation/McDonnell Aircraft Company.
MFG0	— (ICAM) Architecture of Manufacturing.
MRP	— Materials Requirements Planning.
NAD	— Needs Analysis Document.
NBS	— National Bureau of Standards.
N/C	— Numerical Control.
NDE	— Nondestructive Evaluation.
NDML	— Neutral Data Manipulation Language.
NDT	— Nondestructive Test.
NTSB	— National Transportation Safety Board.
NVI	— Name/Value Interface.
OGP	— Optical Gaging Products, Inc.
PA/QA	— Product Assurance/Quality Assurance.
PD	— Product Data.
PDD	— Product Definition Data.
PDDI	— Product Definition Data Interface Program.
PDES	— Product Data Exchange Specification.
PDL	— Program Design Language.
PED	— Preliminary Engine Design.
PI	— Principal Investigator.
PID	— PDDI Interim Database.
PIES	— Product Information Exchange System.
PMP/PMS	— Program Management Plan/Project Master Schedule.
PROCAP	— Process Capability.
PS	— Product Specification.
RFC	— Retirement for Cause Disk Inspection System.
RPM	— Revolutions per Minute.
SA-ALC	— San Antonio-Air Logistics Center.
SAD	— State-of-the-Art Document.
SD	— Scoping Document.
SDL	— Source Data List.
SDS	— System Design Specification.
SL	— Salvage Layout.
SML	— Source Material Log.
SOA	— State-of-the-Art (Survey).
SOR	— Surface of Revolution.
SPC	— Statistical Process Control.
SPF	— System Panel Facility.
SQA	— Software Quality Assurance.
SQAP	— Software Quality Assurance Plan.
SRD	— System Requirements Document.
SRL	— Systems Research Laboratories.
SS	— System Specification.
STEP	— Standard for the Exchange of Product Model Data.
STP	— System Test Plan.
TCTO	— Time Compliance Technical Order.
TD	— Technical Data.
TDCR	— Turbine Design Cost Reduction.
TDR	— Tool Design Request.

TechMod	— Technology Modernization.
TO	— Technical Order.
TOP	— Technical and Office Protocol.
TSO	— Time-Sharing Option (IBM term).
UFUNC	— User Function.
UG	— Unigraphics.
UGFM	— Unigraphics File Manager.
USA	— Unified System for Airfoils.
USAF	— United States Air Force.
UTC	— United Technologies Corporation.
UTP	— Unit Test Plan.
UTR	— Unit Test Report.
UTRC	— United Technologies Research Center.
VAX	— Virtual Architecture Extended.
VMS	— Virtual Memory System.
WBS	— Work Breakdown Structure.
WF	— Working Form.
WPAFB	— Wright-Patterson Air Force Base.
XIM	— X-Ray Inspection Module.

SECTION 3

SYSTEM OPERATIONS

3.1 SYSTEM OVERVIEW

The purpose of the GMAP/Product Definition Data Interface (PDDI) software system is to provide a prototype for the communication of complete product definition data (PDD) between dissimilar CAD/CAM Systems. This system will serve as the information interface between engineering and manufacturing functions. It is composed of Model Access Software (MAS) with Name Value Interface (NVI), Conceptual Schema, Exchange Format (EF), Schema Manager, and the System Translator. The relationship of these components is illustrated in Figure 3-1.

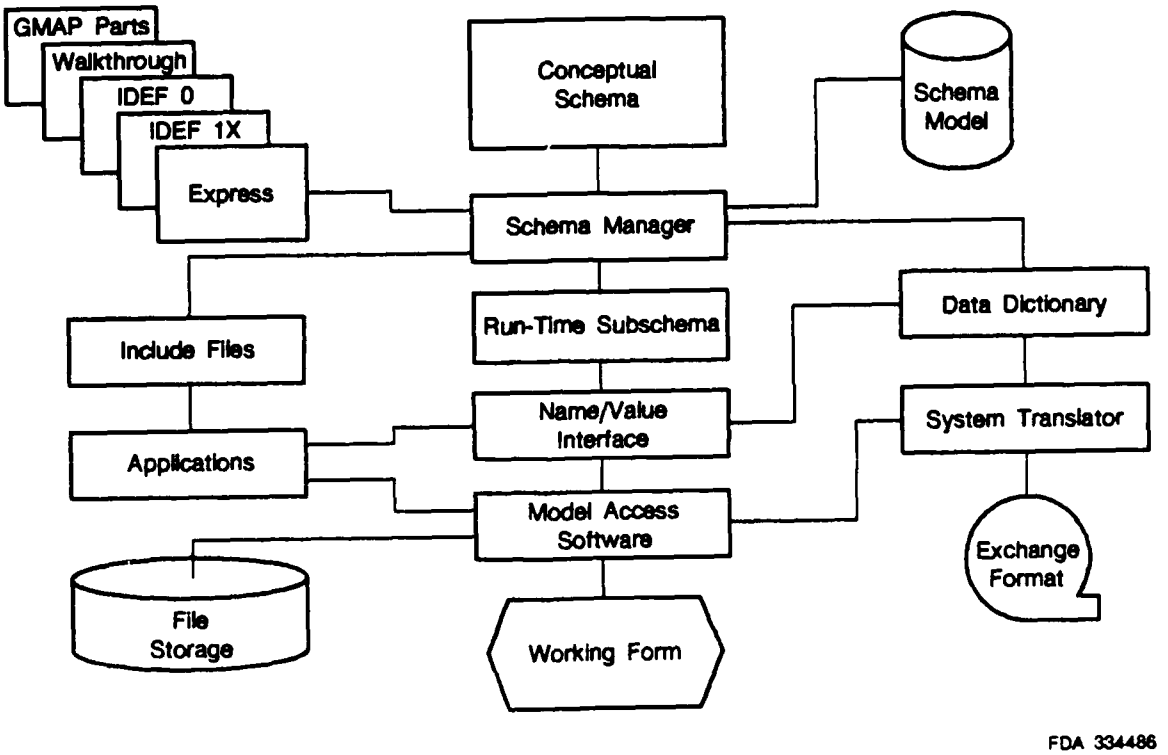

Figure 3-1. GMAP/PDDI Architecture

The MAS is a set of callable utility programs that will allow applications to manipulate and query PDD Working Form (WF) models. The NVI is an enhancement to the MAS which frees applications programmers from the need to be concerned with the physical location of attribute values for entities within the WF. The Conceptual Schema is a Data Dictionary that defines the data needed to create a CAD/CAM model. The Schema Manager is a software tool that is used to manage all aspects of the creation and interrogation of the Conceptual Schema. It creates an "active" information model of the Conceptual Schema. This information model becomes the master representation of the Conceptual Schema, and is used to generate a physical schema. The

EF is a neutral physical sequential format for passing data between dissimilar systems. The System Translator is the software mechanism for passing these data between the EF and the WF of the PDD.

3.1.1 Physical Schemas

The EF physical schema is determined by the GMAP Conceptual Schema and the specification for the neutral file format. The WF physical schema is generated from the Conceptual Schema, with data items rearranged to conserve memory resident memory. The content of any WF entity is the same as its Conceptual Schema definition; however, the order of the data items within memory may be different for storage efficiency reasons.

3.1.2 Software Packages

The software for the system consists of three packages — MAS with NVI, Schema Manager, and System Translator.

3.1.2.1 Model Access Software (MAS)

The MAS creates and manages the WF of a model and provides access to the model at the entity level. For GMAP, access to the model was extended to a sub-entity, or attribute level, by the NVI, which provides run-time binding to the physical schema. The MAS is independent of the data structures (i.e., schema) of the model. Therefore, the MAS can be used for models based on the PDDI Schema, the GMAP Schema, or any other schema without alteration, i.e., Product Data Exchange Specification (PDES).

The MAS provides the utility functions which the System Translator uses to translate the EF data file into or out of the WF representation of a CAD/CAM system. Once the data are in the WF, the data can be accessed and manipulated by an application program through subroutine calls to the MAS.

The MAS operates on the data structure of the application and the WF by using either entity or list operations. The entity operations allow the user to create, delete, modify, and query entities. List operations manage the lists which are temporary data structures containing references to entities (keys). An application can build and maintain lists specifically for its needs.

The NVI frees an application programmer from the need to know the physical location of attribute values for entities within the WF. The application programmer need only know the attribute name and data type, from the physical schema definition, to access or store an attribute value. This capability insulates the application program source code from some physical data structure changes and reduces the need for the application programmer to program and maintain attribute data structures and access algorithms.

The NVI provides the following capabilities:

- DIRECT QUERY SUBPROGRAMS, called by application programs to query an attribute value for a specified entity (including an attribute for a constituent entity)

- DIRECT STORE SUBPROGRAMS, called by application programs to replace an attribute value for a specified entity (including an attribute for a constituent entity)

- PROCEDURAL QUERY SUBPROGRAMS, called by application programs that require a list of entities with a specified attribute value (including an attribute for a constituent entity).

3.1.2.2 Schema Manager

The Schema Manager is the software package used to manage the definitions of the CAD/CAM entities contained in the WF. It produces PASCAL include files for use by application programs at compile time, and Data Dictionary files for use by application programs at run-time. The Schema Manager architecture is illustrated in Figure 3-2.

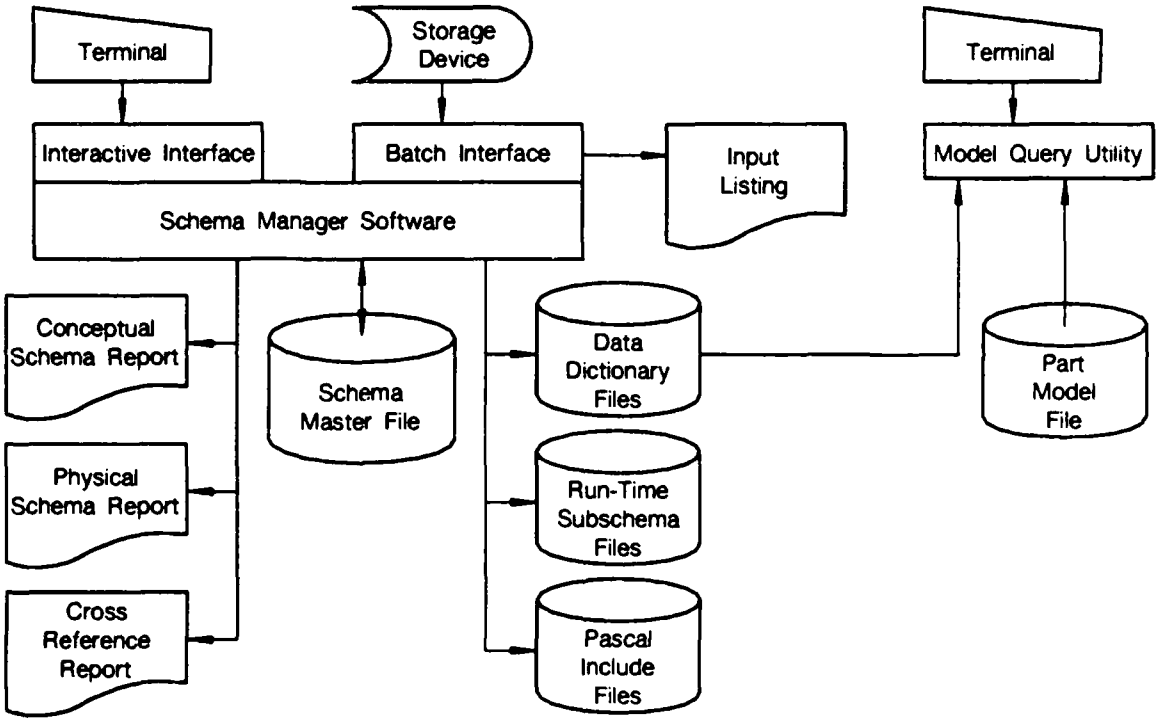

Figure 3-2. GMAP Schema Manager Architecture

The Schema Manager software was developed in the IBM computer system environment using the Standard Panel Facility (SPF) Dialog Manager for full-screen terminal menus. While it is possible to migrate the Schema Manager to other computer systems, this was not in the scope of the contracted effort. Instead, the PASCAL include files and Data Dictionary files were migrated to the VAX computer system environment for use by the GMAP System Translator and other application programs.

The Schema Manager has three major functions:

1. Model a concrete conceptual schema

2. Transform a concrete conceptual schema into a physical schema suitable for the WF of the MAS

3. Generate subschema forms of the physical schema for use by application programs at compile-time and/or run-time.

The Schema Manager consists of three main sub-packages: the Interactive interface, the Batch interface, and the Model Query Utility.

The functions of the Interactive interface include the creation, review, update, reporting, filing, and retrieving of entity definitions. The Interactive interface makes use of the IBM/System Panel Facility (SPF) Dialog Manager for full-screen terminal menus.

The Batch interface provides a mechanism for the creation, reporting, and filing of entity definitions in a noninteractive mode. The Batch interface uses the syntax of the EXPRESS information modeling language for input.

The Model Query Utility provides a mechanism for querying the (part model) entities in the WF. The entity definitions are used to translate the WF binary representation of the (part model) entities into a list of the attribute names and their values. The Model Query Utility makes use of the IBM/SPF Dialog Manager for full-screen terminal menus.

3.1.2.3 System Translator

The System Translator is used to transmit the PDD between systems using a PDES structured file. The preprocessor portion of the translator provides the interface from the MAS WF to the EF file. The postprocessor portion of the translator provides the interface from the EF file to the MAS WF data.

The System Translator works in conjunction with an application translator on a native CAD/CAM system to convert the PDD from a WF physical structure to an EF physical structure or from the EF structure to the WF structure.

The EF is the neutral physical structure which provides uniform data description across application definitions. The EF file is the medium used to transcend differing hardware configurations.

The translated forms of the PDD in the System Translator have a fixed relationship to the structures contained in the language of the schema. The System Translator is thus, largely independent of the content of the PDD and is insensitive to changes in PDD content.

When translating a model, the System Translator interfaces with the GMAP Data Dictionary. The Data Dictionary is used to map the WF entities to the PDES file structure. If no Data Dictionary entry exists for an entity, the translator does not recognize it and it is not translated.

3.2 SYSTEM INTERFACES

The GMAP system component software must interface with the computer system on which it is installed, the local (native) CAD/CAM database, the EF, the WF, and the user (application). As illustrated in Figure 3-3, it does this via the MAS, the GMAP System Translator, and local (native) developed software packages.

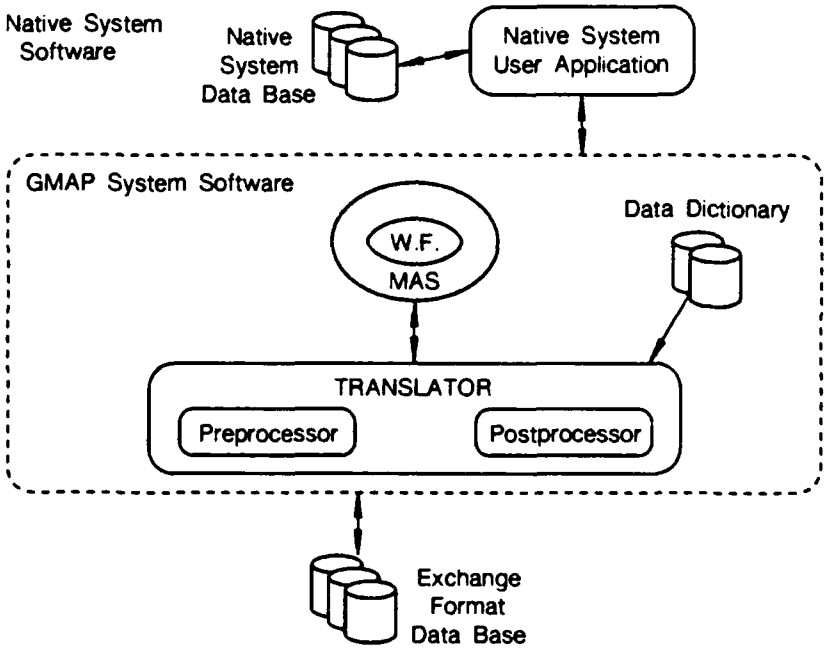

Figure 3-3. GMAP System Translator Software Architecture

3.3 SYSTEM ENVIRONMENT

The GMAP system component software was developed in the computing environment described below.

Computer/Operating System

IBM 43XX/MVS with TSO/MVS and associated tape drives, disk drives, and terminals.
DEC VAX 11/780 VMS with associated tape drives, disk drives, and terminals.

Storage (Core) Requirements

Maximum Core requirements for the GMAP software and the database is 1.0M plus the model size.

Compilers

IBM-PASCAL/VS Release 2.2
DEC-PASCAL V3.5

Terminals

IBM 327X (or equivalent for graphic new applications)
E&S PS300 (or equivalent for graphics applications)

The GMAP system is transportable to other computing systems. However, appropriate local (native) interfaces (translator) must be provided.

SECTION 4

SYSTEM INSTALLATION

4.1 OVERVIEW

The GMAP System Translator uses the EF file to transfer PDD between systems. The EF file is a neutral data file accessible by a CAD/CAM system with suitable translation capabilities.

The EF file may be translated by the receiving system, using the GMAP System Translator, and placed into the memory resident WF. The MAS accepts this transformed data and puts it in the WF.

Conversely, the memory resident WF can be accessed using the MAS, translated using the GMAP System Translator, and placed into the EF file.

A local (native) conversion utility is required to store the WF in the file/retrieve format of the native systems.

Conversely, the native system can use this utility to retrieve the WF model from local (native) storage and put it in the EF using the MAS and the GMAP System Translator. Local software should be written to file and retrieve from the local database. (See Figure 3-3.)

4.2 OPERATION

4.2.1 Introduction

The exchange medium for the GMAP software is typically two magnetic tapes for each computer system (IBM and VAX). One tape contains the GMAP software and the other contains GMAP EF files of the GMAP parts. The contents of these files are tabulated in Appendix A. Appendix B provides PASCAL (extended) implementation differences.

4.2.2 Files

The GMAP system uses a collection of files to provide and hold data used by the system. These files have been assigned logical names and, therefore, the names must be edited to reflect native system requirements. Appendix C provides a listing of the files used with a description of their functions. These data files include Data Dictionaries, Message Tables, and so on.

4.2.3 Operator Interface

From a terminal on the native system, the operator executes a series of CLISTS and JCL on IBM or Command files on VAX to enact installation. The basic functions performed during system installation are compile and link.

4.2.3.1 Compile

The compile phase produces object code from source code. This object code is then used in the linkage editor. The IBM JCL and VAX Command files used to compile the GMAP software

subsystems (Translator, MAS, Schema Manager, NVI, and Model Query Utility) are listed in Tables A-7 and A-8.

4.2.3.2 Link

The IBM Linkage Editor produces the load module from the object code generated during the compile phase. The VAX linker produces the executable image from the object library generated during the compile phase.

4.3 INSTALLATION PROCEDURES

4.3.1 Introduction

The VAX Command files and IBM CLIST and JCL files provided for installation are the same used in the development of the GMAP prototype system. These files do not include native system procedures. Vendor hardware and operating system manuals provide the necessary instructions for basic functions, (i.e., loading tapes, native system start-up, and device initialization). Other procedures needed to operate a native system should be obtained prior to GMAP system installation.

4.3.2 Preliminary Steps

Preliminary steps needed to operate a native system are to:

- Ensure that all necessary documentation is current and available — routine descriptions are listed in the Product Specification
- Ensure that appropriate personnel are familiar with the operation of the native system
- Ensure that adequate native system resources are available
- Obtain the current GMAP system software and EF tapes
- Mount and read the GMAP tapes.

4.3.3 Procedures — GMAP Software

A. GMAP IBM Software Installation

1. In Table A-5, all the necessary GMAP source, include, and data datasets are listed. In Table A-7, all the necessary GMAP JCL and CLIST datasets needed to compile, link, and execute the software are listed. These datasets, listed in Tables A-5 and A-7, may need to be changed to reflect your system libraries, naming conventions, and syntax differences between MVS and VM.

Note: Any name changes to datasets listed in Table A-5 will need to be reflected in the related Table A-7 datasets.

2. Create an object dataset for each GMAP source dataset listed in Table A-5.

   For example:

   source: **CAD5.GMAP.V40.MASSRC**
   object: **CAD4.GMAP.V40.MASOBJ**

3. Compile the GMAP source routines into object datasets. All JCL to compile the source routines are in the dataset **CAD5.GMAP.V40.CNTL.**

   To compile the Translator routines, use the IBM JCL:

   COMTRN

   To compile the MAS routines, use the IBM JCL:

   COMMAS

Refer to Section 4.3.4.

   To compile the NVI routines, use the IBM JCL:

   COMNVI

   To compile the Schema Manager routines, use the IBM JCL:

   COMSCMB
   COMMQU
   COMRTS
   COMSCMI

4. Link the object into subsystem modules. The subsystems are:

   MODEL ACCESS SOFTWARE (MAS)
   NAME VALUE INTERFACE (NVI)
   RUN-TIME SUBSCHEMA (RTS)
   GMAP SYSTEM TRANSLATOR (TRN)

   To link the MAS subsystem, use IBM JCL:

   LINKMAS

   To link the NVI subsystem, use IBM JCL:

   LINKNVI

   To link the RTS subsystem, use IBM JCL:

   LINKRTS

To link the TRN subsystem, use IBM JCL:

LINKTRN

5. Link the subsystem modules into executable load modules. The executable systems are:

   INTERACTIVE SCHEMA MANAGER (SCMI)
   BATCH SCHEMA MANAGER (SCMB)
   MODEL QUERY UTILITY (MQU)

   To link the SCMI system, use IBM JCL:

   LINKSCMI

   To link the SCMB system, use IBM JCL:

   LINKSCMB

   To link the MQU system, use IBM JCL:

   LINKMQU

6. Run the executable load module. All CLISTS to run the executable load modules are in the dataset **CAD5.GMAP.V40.CLIST.** Note: The INTERACTIVE SCHEMA MANAGER (SCMI), the BATCH SCHEMA MANAGER (SCMB), and the MODEL QUERY UTILITY (MQU) are all executed through IBM/MVS ISPF panels. Also note: The MODEL ACCESS SOFTWARE and GMAP TRANSLATOR are subsystems and are not run independently. They are executed by a Using Application.

   To run the SCMI or SCMB executable load module, use CLIST:

   RUNSCHM

   To run the MQU executable load module, use CLIST:

   RUNMQU

B. GMAP VAX Software Installation

1. In Table A-5, all the necessary GMAP source, include, and data files are listed. In Table A-8, all the necessary GMAP command files needed to compile, link, and execute the software are listed.

Note: Any changes to the naming conventions of the directories listed in Table A-5 will need to be reflected in the related Table A-8 command files.

2. Create an object directory for each GMAP source directory listed in Table A-5.

ie source: **[GMAP.V40.MASSRC]**
object: **[GMAP.V40.MASOLB]**

3. Compile the GMAP source files into object libraries. All command procedures to compile the source files are in the directory **[GMAP.V40.COMFI]**

   To compile the GMAP System Translator routines, use the command procedure:

   COMPILE TRN

   To compile the MAS routines, use the command procedure:

   COMPILE MAS

   To compile the NVI routines, use the command procedure:

   COMPILE NVI

4.3.4 Linking GMAP Subsystems into a User Application

The GMAP subsystems may be referenced in a user application by linking the appropriate subsystem into the application.

Example of linking the MAS subsystem into a IBM application

If an application PASCAL procedure calls a MAS interface routine, it must be compiled with a reference to the Include dataset to allow type checking of the call parameter list. This is accomplished in the IBM PASCAL/VS compiler by using the %INCLUDE facility, as follows:

1. Allocate the include file to the compile step. DDNAME(SYSLIB) **DSN(/CAD5.GMAP.V40.MASINC')**

2. Reference the include member in the application PROCEDURE $INCLUDE MA**xxxx** where MA**xxxx** is the interface routine name.

To build a load module that contains the MAS (MAS), in the IBM Linkage Editor step of the job:

1. **//MASLIB DD DSN=CAD2.GMAP.MAS.LOAD, DISP=SHR**
2. **//SYSLIN ***
   INCLUDE MASLIB(MAS)

This example allocates the MAS data set to the DDNAME of MASLIB, then allows the inclusion of the MAS load module from the allocated MASLIB.

APPENDIX A

GMAP SOFTWARE INSTALLATION

Four magnetic tapes containing the IBM and VAX versions of the GMAP deliverable software and EF files are available from the Air Force. The tapes are appropriately labeled as IBM or VAX and as software or EF files.

The IBM tapes were written using the IBM utility IEHMOVE (refer to Table A-1 and Table A-2) and are formatted as follows:

Software Files	Exchange Format Files
1600 bpi	1600 bpi
Label = GMAP	No Label
Fixed Block	Fixed Block
Recordlength = 80	Recordlength = 80
Blocksize = 800	Blocksize = 800

The VAX tapes were written using the DEC standard BACKUP utility and are formatted as follows (refer to Table A-3 and Table A-4).

Software and Exchange Format Files

1600 bpi
Label = GMAP
Recordlength = 80
Blocksize = 800

The datasets described in Table A-5 identify the individual GMAP software components. Detailed descriptions of the software can be found in the GMAP RFC As-Built Product Specification.

The datasets described in Table A-6 identify the EF files of the models created for GMAP.

Table A-7 describes JCL and CLIST files that were used to compile, link, and run the software on an IBM/MVS System at MCAIR. If the user is installing the software on IBM hardware with an MVS operating system, these files can be used with only a few minor changes (replace MCAIR specific system libraries with your own). If the software is being installed on IBM hardware with a VM operating system, these files can only be used as a guide. There are significant changes required for use with the VM operating system.

Table A-8 describes Command Files that were used to compile, link, and run the software on a VAX/VMS System at MCAIR. If the user is installing the software on DEC hardware with a VMS operating system, these files can be used without any changes to them.

TABLE A-1

GMAP SOFTWARE TAPE JCL
IBM/MVS

```
//TM360JPT JOB ACCNTNO,/GMAP',NOTIFY=TM360JP,
//     REGION=3000K,MSGCLASS=T,LIM=(30,90,60,60)
//*FORMAT PR,DDNAME,=DEST=N002
//*MAIN CLASS=A
//S1   EXEC PGM=IEHMOVE
//SYSPRINT DD SYSOUT=*
//SYSUT1 DD UNIT=SYSDA,SPACE=(TRK,(8))
//TAPE1   DD UNIT=TAPE62,DISP=(,PASS),LABEL=(,SL),DCB=DEN=3,
//           VOL=SER=(GMAP)
//DD1     DD UNIT=3380,DISP=SHR,VOL=SER=LH02D0
//SYSIN DD *
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,01),      X
     DSNAME=CAD5.GMAP.V40.CLIST
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,02),      X
     DSNAME=CAD5.GMAP.V40.CNTL
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,03),      X
     DSNAME=CAD5.GMAP.V40.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,04),      X
     DSNAME=CAD5.GMAP.V40.DDDEFN.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,05),      X
     DSNAME=CAD5.GMAP.V40.DDINDX.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,06),      X
     DSNAME=CAD5.GMAP.V40.MASINC
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,07),      X
     DSNAME=CAD5.GMAP.V40.MASSRC
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,08),      X
```

TABLE A-2

GMAP EXCHANGE FORMAT FILES TAPE JCL
IBM/MVS

```
//TM360JPT JOB ACCNTNO,/GMAP',NOTIFY=TM360JP,
//    REGION=3000K,MSGCLASS=T,LIM=(30,90,60,60)
//*FORMAT PR,DDNAME,=DEST=N002
//*MAIN CLASS=A
//S1  EXEC PGM=IEHMOVE
//SYSPRINT DD SYSOUT=*
//SYSUT1 DD UNIT=SYSDA,SPACE=(TRK,(8))
//TAPE1  DD UNIT=TAPE62,DISP=(,PASS),LABEL=(,NL),DCB=DEN=3,
//          VOL=SER=(GMAP)
//DD1    DD UNIT=3380,DISP=SHR,VOL=SER=LH02D0
//SYSIN DD *
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,01),                X
               DSNAME=CAD5.GMAP.V40.EF.B1SC.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,02),                X
               DSNAME=CAD5.GMAP.V40.EF.COMRIB.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,03),                X
               DSNAME=CAD5.GMAP.V40.EF.ELECTRIC.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,04),                X
               DSNAME=CAD5.GMAP.V40.EF.MACRIB3.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,05),                X
               DSNAME=CAD5.GMAP.V40.EF.MACRIB5.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,06),                X
               DSNAME=CAD5.GMAP.V40.EF.SMRIB.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,07),                X
               DSNAME=CAD5.GMAP.V40.EF.TSTMOD.DATA
  COPY TODD=TAPE1,FROM=3380=LH02D0,TO=TAPE62=(GMAP,08),                X
               DSNAME=CAD5.GMAP.V40.EF.TURNPT.DATA
/*
//
```

TABLE A-3

GMAP SOFTWARE TAPE DCL
VAX/VM

```
$ SET VERIFY
$!
$! THIS WILL CREATE A TAPE OF THE GMAP SYSTEM SOFTWARE
$!
$ DELETE TAPE_LIST.LST;*
$ INIT/DENSITY=1600 MUA0:  GMAP
$ MOUNT/FOREIGN MUA0: GMAP
$
$!  COPY COMMAND PROCEDURES FOR COMPILING, LINKING, AND RUNNING
$
$ BACKUP/LOG/VERIFY/LIST=TAPE_LIST.LST -
    [GMAP.V40.COMFIL]ASSIGN_DIR.COM;,-
    [GMAP.V40.COMFIL]ASSIGN_TRN_BATCH.COM;,-
    [GMAP.V40.COMFIL]ASSIGN_TRN_INTER.COM;,-
    [GMAP.V40.COMFIL]COMPILE_MAS.COM;,-
    [GMAP.V40.COMFIL]COMPILE_NVI.COM;,-
    [GMAP.V40.COMFIL]COMPILE_TRN.COM;,-
    [GMAP.V40.COMFIL]INC_ASSIGN_MAS.COM;,-
    [GMAP.V40.COMFIL]INC_ASSIGN_NVI.COM;,-
    [GMAP.V40.COMFIL]INC_ASSIGN_TRN.COM;,-
    [GMAP.V40.COMFIL]TRN_LINK.COM -
    MUA0:COMTIL.BKP/SAVESET
$
$!  COPY DATA DICTIONARY AND PASCAL INCLUDE FILES
$
$ BACKUP/LOG/VERIFY/LIST=TAPE_LIST.LST -
    [GMAP.V40.DDFILS]GMAP_DDD.DAT;,-
    [GMAP.V40.DDFILS]GMAP_DDI.DAT;,-
    MUA0:DDFILS.BKP/SAVESET
$
$!  COPY MAS INCLUDE FILES
$
$ BACKUP/LOG/VERIFY/LIST=TAPE_LIST.LST -
    [GMAP.V40.MASINC]*.* -
    MUA0:MASINC.BKP/SAVESET
$
$!  COPY MAS SOURCE FILES
$
$ BACKUP/LOG/VERIFY/LIST=TAPE_LIST.LST -
    [GMAP.V40.MASSRC]*.* -
    MUA0:MASSRC.BKP/SAVESET
```

```
$
$!  COPY NVI INCLUDE FILES
$
$ BACKUP/LOG/VERIFY/LIST=TAPE_LIST.LST -
    [GMAP.V40.NVIINC]*.* -
    MUA0:NVIINC.BKP/SAVESET
$
$!  COPY NVI SOURCE FILES
$
$ BACKUP/LOG/VERIFY/LIST=TAPE_LIST.LST -
    [GMAP.V40.NVISRC]*.* -
    MUA0:NVISRC.BKP/SAVESET
$
$!  COPY TRAN INCLUDE FILES
$
$ BACKUP/LOG/VERIFY/LIST=TAPE_LIST.LST -
    [GMAP.V40.TRNINC]*.* -
    MUA0:TRNINC.BKP/SAVESET
$
$!  COPY TRAN SOURCE FILES
$
$ BACKUP/LOG/VERIFY/LIST=TAPE_LIST.LST -
    [GMAP.V40.TRNSRC]*.* -
    MUA0:TRNSRC.BKP/SAVESET
$
$ DISMOUNT/NOUNLOAD MUA0:
$ COPY/CONCATENATE TAPE_LIST.LST;* GMAP_V40_TAPE.LST
$ SET NOVERIFY
$ EXIT
```

TABLE A-4

GMAP EXCHANGE FORMAT FILES TAPE DCL
VAX/VM

```
$ SET VERIFY
$!
$! THIS WILL CREATE A TAPE OF THE EXCHANGE FORMATS FOR THE GMAP MODELS
$!
$ DELETE TAPE_LIST.LST;*
$ INIT/DENSITY=1600 MUA0:  GMAP
$ MOUNT/FOREIGN MUA0: GMAP
$
$!  COPY COMMAND PROCEDURES FOR COMPILING, LINKING, AND RUNNING
$
$ BACKUP/LOG/VERIFY/LIST=TAPE_LIST.LST -
    [GMAP.V40.EFFILS]B1SC.DAT;,-
    [GMAP.V40.EFFILS]COMRIB.DAT;,-
    [GMAP.V40.EFFILS]ELEC.DAT;,-
    [GMAP.V40.EFFILS]MACRIB3.DAT;,-
    [GMAP.V40.EFFILS]MACRIB5.DAT;,-
    [GMAP.V40.EFFILS]SMRIB.DAT;,-
    [GMAP.V40.EFFILS]TSTMOD.DAT;,-
    [GMAP.V40.EFFILS]TURNPT.DAT -
    MUA0:EFFILS.BKP/SAVESET
$ DISMOUNT/NOUNLOAD MUA0:
$ COPY/CONCATENATE TAPE_LIST.LST;* GMAP_V40_EF.LST
$ SET NOVERIFY
$ EXIT
```

TABLE A-5

GMAP SOFTWARE COMPONENTS

File Name	Hardware	Description
GMAP.V40.MASINC]	VAX	Contains MAS PASCAL include files.
CAD5.GMAP.V40.MASINC	IBM	
[GMAP.V40.MASSRC]	VAX	Contains MAS source files.
CAD5.GMAP.V40.MASSRC	IBM	
CAD5.GMAP.V40.MQUINC	IBM	Contains Model Query Utility PASCAL include files.
CAD5.GMAP.V40.MQUSRC	IBM	Contains Model Query Utility source files.
CAD5.GMAP.V40.MQUPAN	IBM	Contains Model Query Utility SPF panels.
CAD5.GMAP.V40.MQUMSG	IBM	Contains Model Query Utility SPF Panel message libraries.
[GMAP.V40.NVIINC]	VAX	Contains NVI PASCAL include files.
CAD5.GMAP.V40.NVIINC	IBM	
[GMAP.V40.NVISRC]	VAX	Contains NVI source files.
CAD5.GMAP.V40.NVISRC	IBM	
CAD5.GMAP.V40.RTSINC	IBM	Contains Run-Time Subschema PASCAL include files.
CAD5.GMAP.V40.RTSSRC	IBM	Contains Run-Time Subschema source files.
CAD5.GMAP.V40.SCMBINC	IBM	Contains Batch Schema Manager (SCMB) PASCAL include files.
CAD5.GMAP.V40.SCMBSRC	IBM	Contains Batch Schema Manager (SCMB) source files.

Table A-5 (contd)

File Name	Hardware	Description
CAD5.GMAP.V40.SCMIINC	IBM	Contains Interactive Schema Manager (SCMI) PASCAL include files.
CAD5.GMAP.V40.SCMISRC	IBM	Contains Interactive Schema Manager (SCMI) source files.
CAD5.GMAP.V40.SCMIPAN	IBM	Contains Interactive Schema Manager (SCMI) SPF panels.
CAD5.GMAP.V40.SCMIMSG	IBM	Contains Interactive Schema Manager (SCMI) message libraries.
[GMAP.V40.TRNINC]	VAX	Contains GMAP System Translator (TRN) PASCAL include files.
CAD5.GMAP.V40.TRNINC	IBM	
[GMAP.V40.TRNSRC]	VAX	Contains GMAP System Translator (TRN) source files.
CAD5.GMAP.V40.TRNSRC	IBM	
CAD5.GMAP.V40.DDDEFN.DATA	IBM	GMAP Data Dictionary.
CAD5.GMAP.V40.DDINDX.DATA	IBM	GMAP Data Dictionary index file.
[GMAP.V40.DDFILS]	VAX	Contains Data Dictionary, data dictionary index file.

TABLE A-6

GMAP EF FILES

File Name	Hardware	Description
[GMAP.V40.EFFILS]B1SC.DAT	VAX	Contains GMAP EF file for the B1 Spar Clip.
CAD5.GMAP.V40.EF.B1SC.DATA	IBM	
[GMAP.V40.EFFILS]COMRIB.DAT	VAX	Contains GMAP EF file for the Composite Rib.
CAD5.GMAP.V40.EF.COMRIB.DATA	IBM	
[GMAP.V40.EFFILS]ELECTRIC.DAT	VAX	Contains GMAP EF file for the Electronic Part.
CAD5.GMAP.V40.EF.ELECTRIC.DATA	IBM	
[GMAP.V40.EFFILS]MACRIB3.DAT	VAX	Contains GMAP EF file for the 3-Axis Machined Rib.
CAD5.GMAP.V40.EF.MACRIB3.DATA	IBM	
[GMAP.V40.EFFILS]MACRIB5.DAT	VAX	Contains GMAP EF file for the 5-Axis Machined Rib.
CAD5.GMAP.V40.EF.MACRIB5.DATA	IBM	
[GMAP.V40.EFFILS]SMRIB.DAT	VAX	Contains GMAP EF file for the Sheet Metal Rib.
CAD5.GMAP.V40.EF.SMRIB.DATA	IBM	
[GMAP.V40.EFFILS]TSTMOD.DAT	VAX	Contains GMAP EF file for the Test Model.
CAD5.GMAP.V40.EF.TSTMOD.DATA	IBM	
[GMAP.V40.EFFILS]TURNPT.DAT	VAX	Contains GMAP EF file for the turned part.
CAD5.GMAP.V40.EF.TURNPT.DATA	IBM	

TABLE A-7

GMAP IBM JCL AND CLISTS

File Name	Description
CAD5.GMAP.V40.CNTL(COMMAS)	IBM/MVS JCL to submit a batch compilation of MAS source.
CAD5.GMAP.V40.CNTL(COMMQU)	IBM/MVS JCL to submit a batch compilation of Model Query Utility source.
CAD5.GMAP.V40.CNTL(COMNVI)	IBM/MVS JCL to submit a batch compilation of NVI source.
CAD5.GMAP.V40.CNTL(COMRTS)	IBM/MVS JCL to submit a batch compilation of Run-Time Subschema (RTS) source.
CAD5.GMAP.V40.CNTL(COMSCMB)	IBM/MVS JCL to submit a batch compilation of Batch Schema Manager (SCMB) source.
CAD5.GMAP.V40.CNTL(COMSCMI)	IBM/MVS JCL to submit a batch compilation of Interactive Schema Manager (SCMI) source.
CAD5.GMAP.V40.CNTL(COMTRN)	IBM/MVS JCL to submit a batch compilation of GMAP System Translator (TRN) source.
CAD5.GMAP.V40.CNTL(LINKMAS)	IBM/MVS JCL to submit a batch link of the MAS load module.
CAD5.GMAP.V40.CNTL(LINKMQU)	IBM/MVS JCL to submit a batch link of the Model Query Utility (MQU) load module.
CAD5.GMAP.V40.CNTL(LINKNVI)	IBM/MVS JCL to submit a batch link of the NVI load module.

File Name	Description
CAD5.GMAP.V40.CNTL(LINKRTS)	IBM/MVS JCL to submit a batch link of the Run-Time Subschema (RTS) load module.
CAD5.GMAP.V40.CNTL(LINKSCMB)	IBM/MVS JCL to submit a batch link of the Batch Schema Manager (SCMB) load module.
CAD5.GMAP.V40.CNTL(LINKSCMI)	IBM/MVS JCL to submit a batch link of the Interactive Schema Manager (SCMI) load module.
CAD5.GMAP.V40.CNTL(LINKTRN)	IBM/MVS JCL to submit a batch link of the GMAP System Translator (TRN) load module.
CAD5.GMAP.V40.CLIST(RUNMQU)	IBM/MVS Clist to execute the Model Query Utility (MQU) module.
CAD5.GMAP.V40.CLIST(RUNSCHM)	IBM/MVS Clist to execute both the Interactive Schema Manager (SCMI) and the Batch Schema Manager (SCMB) module.
CAD5.GMAP.V40.CLIST(ALLODSN, BALLOC, BROWSDSN, EXSCHEMA, FREEDSN, NAME, PRNTDSN)	IBM/MVS Clists to support the execution of both the Interactive Schema Manager (SCMI) and the Batch Schema Manager (SCMB).

TABLE A-8

GMAP VAX COMMAND FILES

File Name	Description
[GMAP.V40.COMFIL]COMPILE_MAS.COM	VAX/VMS Command file to compile MAS source.
[GMAP.V40.COMFIL]COMPILE_NVI.COM	VAX/VMS Command file to compile NVI source.
[GMAP.V40.COMFIL]COMPILE_TRN.COM	VAX/VMS Command file to compile GMAP System Translator (TRN) source.
[GMAP.V40.COMFIL]TRN_LINK.COM	VAX/VMS Command file to link the GMAP System Translator (TRN).
[GMAP.V40.COMFIL]ASSIGN_DIR.COM	VAX/VMS Command file to assign GMAP directory names to logical names.
[GMAP.V40.COMFIL]INC_ASSIGN_MAS.COM	VAX/VMS Command file to assign the MAS PASCAL include files to logical names.
[GMAP.V40.COMFIL]INC_ASSIGN_NVI.COM	VAX/VMS Command file to assign the NVI PASCAL include files to logical names.
[GMAP.V40.COMFIL]INC_ASSIGN_TRN.COM	VAX/VMS Command file to assign the GMAP System Translator (TRN) PASCAL include files to logical names.

APPENDIX B

PASCAL (EXTENDED)
IMPLEMENTATION DIFFERENCES

	IBM		VAX
1.	SEGMENT	1.	MODULE
2.	SEGMENT XXXXX; PROCEDURE XXXXX;	2.	REMOVE PROCEDURE STATEMENT IN MODULE XXXXX
3.	%INCLUDE MEMBER OF PDS	3.	%INCLUDE 'VAXDSN'
4.	%PRINT ON	4.	%INCLUDE 'VAXDSN/LIST' (DEFAULT)
5.	%PRINT OFF	5.	%INCLUDE 'VAXDSN/NOLIST'
6.	%PAGE	6.	PAGE(INPUT OR OUTPUT)
7.	@ POINTER VARIABLE SYMBOL	7.	/ POINTER VARIABLE SYMBOL
8.	CONST IN A PROCEDURE DECLARATION e>g> PROCEDURE PROCNAME(CONST I:INTEGER);	8.	USE [READONLY] ATTRIBUTE e.g. XINEGER=[READONLY] INTEGER; PROCEDURE PROCNAME(I:INTEGER);
9.	LABEL CAN BE A VARIABLE NAME e.g. EXIT OUT:	9.	LABEL HAS TO BE MADE UP OF DECIMAL DIGITS e.g. 10:
10.	// CONCATENATION SYMBOL	10.	+ CONCATENATION SYMBOL
11.	VALUE - USED FOR SPECIFYING INITIAL VALUES FOR STATIC AND DEF VAR.	11.	VALUE - INITIAL VALUES FOR ORDINAL, REAL, AND STRUCTURAL VAR. (EXCEPT FILE VAR.), WITH CONSTANTS OR CONSTRUCTORS OF THE SAME TYPE. CAN ONLY APPEAR IN THE MAIN PROGRAM.
12.	LENGTH(X)	12.	LENGTH(X)
13.	MAXLENGTH(X)	13.	LENGTH(X)
14.	DELETE FUNCTION FOR STRING	14.	USE PAD & SUBSTRING FUNCTION TO SIMULATE DELETE ON IBM
15.	S2:-S1 WHERE S2 & S1 ARE PACKED ARRAY[1..N] OF CHAR 7 S2.GE.S1 - IS LEGAL	15.	NOT LEGAL, TO MAKE IT LEGAL S2 & S1 SHOULD BE DECLARED VARYING[N] OF CHAR
16.	MIN & MAX FUNCTION	16.	CONSTRUCT YOUR OWN MIN & MAX
17.	LTRIM FUNCTION	17.	USE LIB$SPKC,PAD,SUBSTR & LENGTH FUNCTION TO SIMULATE LTRIM ON IBM
18.	READSTR FUNCTION	18.	READV FUNCTION
19.	WRITESTR FUNCTION	19.	WRITEV FUNCTION

PASCAL (EXTENDED)
IMPLEMENTATION DIFFERENCES

	IBM		VAX
20.	PASCAL ALLOWS YOU TO USE A BASE TYPE IDENTIFIER IN A POINTER TYPE DEFINITION BEFORE YOU DEFINE THE BASE TYPE. THE BASE TYPE DOES NOT NEED TO BE DEFINED BEFORE THE END OF TYPE SECTION IN WHICH IT WAS FIRST REFERENCED.	!	20. SAME AS IBM. EXCEPT, THE BASE TYPE MUST BE DEFINED BEFORE THE END OF TYPE SECTION IN WHICH IT WAS FIRST REFERENCED.
21.	SUBPROGRAM	!	21. EXTERNAL
22.	REF DEF X : X_TYPE	!	22. VAR X : [EXTERNAL]X_TYPE
23.	numberX hexadecimal	!	23. %Xnumber hexadecimal
24.	& Binary Logical AND	!	24. UAND Binary Logical AND
25.	SHORTREAL (4 BYTES)	!	25. REAL
26.	REAL (8 BYTES)	!	26. DOUBLE
27.	PACKED (.0..65535.)	!	27. [WORD] 0..65535
28.	PACKED (.0..255.)	!	28. [BYTE] 0..255
29.	STRING (.X.)	!	29. VARYING [X] OF CHAR
30.	RETURN STATEMENT	!	30. USE A GOTO STATEMENT TO END OF ROUTINE

APPENDIX C

DATASETS USED BY GMAP

Any file allocations that need to be performed in the CLIST (IBM), JCL (IBM-BATCH), or DCL (VAX) prior to entry into the native application that uses the GMAP SYSTEM TRANSLATOR are:

DDNAME : DDFILE

Data Set Name : CAD5.GMAP.V40.DDDEFN.DATA

Used By: PRE, POST

Description:

Contains the Data Dictionary definitions.

DDNAME : DDINX

Data Set Name : CAD5.GMAP.V40.DDINDX.DATA

Used By : PRE, POST

Description:

Contains the Data Dictionary index.

DDNAME : EFFILE

Data Set Name : Provided by User

Used By : PRE, POST

Description:

The EF file that is created or processed by the translator.

DDNAME : INPUT

Data Set Name : Set To Default Input

Used By : WF Printout

Description:

Input from terminal screen.

DDNAME : OUTPUT

Data Set Name : Set To Default Output

Used By : WF Printout

Description:

Output to terminal screen from PASCAL.